CLAIMS

I claim:

1. A turbine blade, comprising:

a generally elongated blade having a leading edge, a trailing edge, and a tip at a first end, a root coupled to the blade at an end generally opposite the first end for supporting the blade and for coupling the blade to a disc, and at least one cavity forming a cooling system in the blade;

the generally elongated blade formed from at least one outer wall defining the at least one cavity forming the cooling system;

at least one first impingement rib positioned generally parallel to the trailing edge of the elongated blade and contacting the at least one outer wall;

at least one second impingement rib oblique to the at least one first impingement rib and extending from the at least one first impingement rib toward the trailing edge;

at least one third impingement rib oblique to the at least one first impingement rib, extending from the at least one first impingement rib toward the trailing edge, and intersecting the at least one second impingement rib, thereby forming at least one triangular cavity;

at least one orifice in the at least one first impingement rib opening into the at least one triangular cavity; and

at least one orifice in the at least one second impingement rib opening into the at least one triangular cavity.

2. The turbine blade of claim 1, wherein the at least one orifice in the at least one second impingement rib opening is oblique relative to the outer wall.

3. The turbine blade of claim 2, wherein the at least one orifice in the at least one second impingement rib opening is positioned between about 30 degrees and about 60 degrees.

4. The turbine blade of claim 1, further comprising at least one orifice in the at least one third impingement rib.

5. The turbine blade of claim 4, wherein the at least one orifice in the at least one third impingement rib opening is oblique relative to the outer wall.

6. The turbine blade of claim 5, wherein the at least one orifice in the at least one third impingement rib opening is positioned between about 30 degrees and about 60 degrees.

7. The turbine blade of claim 1, wherein the at least one first impingement rib comprises at least two substantially parallel impingement ribs substantially parallel to the trailing edge.

8. The turbine blade of claim 1, further comprising a plurality of second impingement ribs oblique to the at least one first impingement rib and a plurality of third impingement ribs oblique to the at least one first impingement rib and intersecting at least two of the plurality of second impingement ribs, thereby forming a plurality of triangular cavities.

9. The turbine blade of claim 8, wherein the plurality of second and third impingement ribs oblique to the at least one first impingement rib form a plurality of axial and oblique impingement cooling devices.

10. The turbine blade of claim 9, wherein at least one triangular cavity includes at least one orifice in each side of the at least one triangular cavity.

11. The turbine blade of claim 1, wherein the at least one first impingement rib comprises three substantially parallel impingement ribs forming a plurality of triangular cavities.

12. The turbine blade of claim 11, wherein the at least one orifice in the at least one first impingement rib opening comprises a plurality of orifices in the three substantially parallel impingement ribs, wherein the orifices provide openings into the triangular cavities.

13. The turbine blade of claim 12, wherein the three substantially parallel first impingement ribs comprise an outer impingement rib, an inner impingement rib, and a middle impingement rib and the orifices in the middle impingement rib are offset along the middle impingement rib relative to the orifices in the inner and outer impingement ribs.

14. The turbine blade of claim 1, wherein the at least one second impingement rib is positioned at about 60 degrees relative to the at least one first impingement rib.

15. The turbine blade of claim 1, wherein the at least one third impingement rib is positioned at about 60 degrees relative to the at least one first impingement rib.

16. A turbine engine, comprising:

a combustor positioned upstream from a turbine blade assembly;

the turbine blade assembly having at least one turbine blade;

the at least one turbine blade formed from a generally elongated blade having a leading edge, a trailing edge, and a tip at a first end, a root coupled to the blade at an end generally opposite the first end for supporting the blade and for coupling the blade to a disc, a longitudinal axis extending from the tip to the root, and at least one cavity forming a cooling system in the blade;

the generally elongated blade formed from at least one outer wall defining the at least one cavity forming the cooling system;

at least one first impingement rib positioned generally parallel to the trailing edge of the elongated blade and contacting the at least one outer wall;

at least one second impingement rib oblique to the at least one first impingement rib and extending from the at least one first impingement rib toward the trailing edge;

at least one third impingement rib oblique to the at least one first impingement rib, extending from the at least one first impingement rib toward the trailing edge, and intersecting the at least one second impingement rib, thereby forming at least one triangular cavity;

at least one orifice in the at least one first impingement rib opening into the at least one triangular cavity;

at least one orifice in the at least one second impingement rib opening into the at least one triangular cavity; and

at least one orifice in the at least one third impingement rib.

17. The turbine engine of claim 16, further comprising a plurality of first impingement ribs, a plurality of second impingement ribs oblique to the at least one first impingement rib, and a plurality of third impingement ribs oblique to the at least one first impingement rib and intersecting at least two of the plurality of second impingement ribs, thereby forming a plurality of triangular cavities having at least one orifice in each side of the at least one triangular cavity.

18. The turbine engine of claim 17, wherein the at least one orifice in the at least one second impingement rib opening is oblique relative to the outer wall and the at least one orifice in the at least one third impingement rib opening is oblique relative to the outer wall.

19. The turbine engine of claim 18, wherein the at least one orifice in the at least one second impingement rib opening is positioned between about 30 degrees and about 60 degrees and the at least one third impingement rib opening is positioned between about 30 degrees and about 60 degrees.

20. The turbine engine of claim 16, wherein the at least one second impingement rib and the at least one third impingement rib are positioned at about 60 degrees relative to the at least one first impingement rib.